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NEW RECORDS OF SUBLITTORAL ALGAE FROM THE CANARY ISLANDS

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ABSTRACT - Seven species of sublittoral algae are here reported from the Canary Islands for the first time: *Corynophlaea cystophorae* J. Agardh, *Cladophora conferta* P. et H. Crouan ex Schramm et Mazé, *Predaea ollivieri* J. Feldmann, *Chondria mairei* G. Feldmann, *Champia vieillardii* Kützing, *Champia salicornoides* Harvey and *Chrysymenia ventricosa* (Lamouroux) J. Agardh. Data about their phytogeography and habitat as well as a brief description and discussion are provided for each species.

RÉSUMÉ - Les auteurs signalent sept espèces nouvelles pour la flore des algues marines des Iles Canaries: *Corynophlaea cystophorae* J. Agardh, *Cladophora conferta* P. et H. Crouan ex Schramm et Mazé, *Predaea ollivieri* J. Feldmann, *Chondria mairei* G. Feldmann, *Champia vieillardii* Kützing, *Champia salicornoides* Harvey et *Chrysymenia ventricosa* (Lamouroux) J. Agardh. Pour chaque espèce sont donnés la phytogéographie, l'habitat, une brève description et une discussion.

KEY-WORDS - Florisric, macroalgae, Canary Islands, phytogeography.

INTRODUCTION

Between 1991 and 1993, two exhaustive floristic researches were carried out at two poorly known localities, El Médano in the South of Tenerife (Reyes, 1993) and Cotillo in the North-West of Fuerteventura (González-Ruíz, 1993). We report here on several sublittoral species new to the Canary Islands, observed and identified from our field collections.

MATERIAL AND METHODS

Specimens collected were preserved in 4% formalin in seawater and transported to the laboratory where they were sorted and maintained as herbarium specimens, in vials of formalin preservative or as permanent slides prepared by mounting in 20% aqueous Karo® corn-syrup with 1% aniline blue. Plants were deposited at TFC (Departamento de Biología Vegetal, Botánica, Universidad de La Laguna, Islas Canarias), with the following numbers: *Corynophlaea cystophorae*, 7656 (11.02.1993); *Cladophora conferta*, 7794 (29.10.1991); *Predaea ollivieri*, 7908 (14.07.1991);

Chondria mairei, 7822 (14.05.1991); *Champia vieillardii*, 7411 (29.10.1991); *Champia salicornoides*, 7987 (17.04.1993), 8012 (18.04.1993), 8298 (7.04.1993), 8307 (17.10.1993); and *Chrysymenia ventricosa*, 8061 (14.07.1991), 8062 (14.07.1991), 8333 (14.07.1991). Drawings were obtained using a camera lucida in a Zeiss microscope.

RESULTS AND DISCUSSION

Corynophlaea cystophorae J. Agardh (Leathesiaceae, Phaeophyta) (Fig. 1)

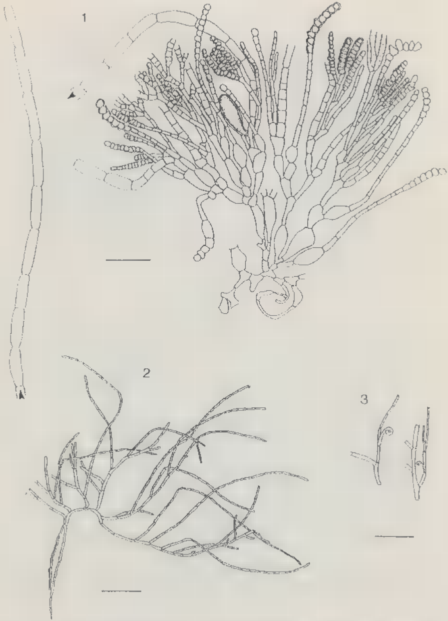
This species was commonly collected growing on several species of *Cystophora* and other genera of Cystoseiraceae (Womersley, 1987). Plants collected both in El Médano and Cotillo were developed on *Cystoseira abies-marina* (Gmelin) C. Agardh in the upper sublittoral, forming small hemispherical cushions, up to 3 mm in diameter. Plants consist of dichotomously branched medullary filaments, compacted together in a gelatinous matrix and easily separable under pressure. Cortical filaments with up to 15 cells, arise in groups of 1-4 developed from upper medullary cells, cylindrical next to their base and with conspicuous lateral enlargement at their upper cells (Fig. 1). Phaeophycean hairs are common and arise from upper medullary cells. Specimens with uniseriate plurilocular sporangia, often borne on slender branch systems, and ovoid unilocular sporangia were observed (Fig. 1).

According to Womersley (1987), *Corynophlaea* contains six species, four of them known in the North Atlantic Ocean and the Mediterranean Sea [*C. hamelii* Feldmann, *C. flaccida* Kützing, *C. umbellata* (C. Agardh) Kützing and *C. crispa* (Harvey) Kuckuck] and two reported from Australasia (*C. cystophorae* and *C. cristata* Womersley et Skinner). Plants very similar to these from the Canary Islands growing also on *Cystoseira abies-marina* were reported by Pedersen (1983), as *C. crispa*, from the island of Madeira although according to Pedersen (personal communication), plants from Madeira would be placed into identity with *C. cystophorae*.

Cladophora conferta P. et H. Crouan ex Schramm et Mazé (Cladophoraceae, Chlorophyta) (Fig. 2-3)

Plants grew on *Codium intertextum* Collins et Hervey in the sublittoral zone at El Médano.

According to Hoek (1982), *Cladophora conferta* has an amphiatlantic tropical distribution being next to *Cladophora prolifera* (Roth) Kützing, a species known in the Canary Islands, from which differs mainly in its more delicate habit (Fig. 2). Morphologically, *Cladophora conferta* resembles *Cladophora nigrescens* Zanardini ex Frauenfeld, a species from the European Mediterranean coasts. The main differences between the last two species are (1) the dull dark colour, remaining even after drying (*C. nigrescens* becoming dark brown), (2) the rhizoids with undulating walls arising from lateral branches near the basal cell (*C. nigrescens* show rhizoids with annular constrictions arising from more distal branches) and (3) the cellular dimensions,



Figs 1-3 - Fig. 1. *Corynophlaea cystophorae* J. Agardh. Upper medullary cells with determinate cortical filaments, clusters of plurilocular sporangia, ■ monosporangium and ■ hair (arrowheads indicate the continuity of the hair). (Scale bar = 50 µm). Figs 2-3. *Cladophora conferta* P. et H. Crouan ex Schramm et Mazé. Fig. 2. Habit. (Scale bar = 600 µm). Fig. 3. Detail of hooked apical cells. (Scale bar = 600 µm).

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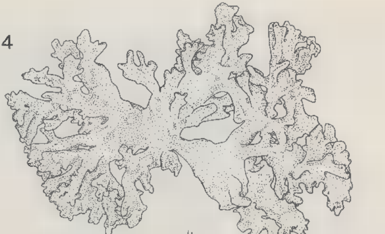

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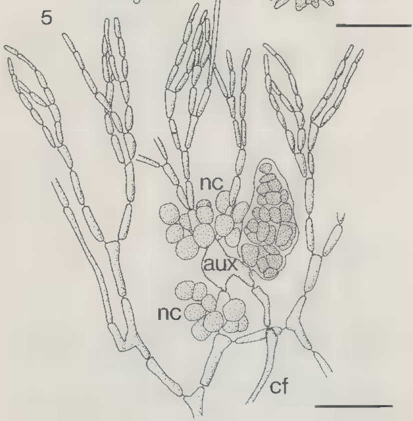

considerably smaller in *C. conferta* (Hoek, 1963). Our plants present several hooked apical cells (Fig. 3), a character that seems to be common in this species.

Predaea ollivieri J. Feldmann (Nemastomataceae, Rhodophyta) (Figs 4-5)

Plants grew epilithically in shallow sublittoral at Cotillo. Specimens studied are female gametophytes, with subcylindrical to flattened habit (Fig. 4), subdichotomously branched towards the margins. Carpogonial branches consist of two cells and the auxiliary cells lie in an intercalary position in the cortical filaments. Small chains of 3-15 rounded nutritive cells, showing a very characteristic morphology in this species, arise from the proximal and two distal cells adjacent to the auxillary cell (Fig. 5). Fertilized carpogonium cut off 1-3 pluricellular branched connecting filaments that fuse with auxiliary cells. Subconical carposporophyte develops from a lateral bulge of the connecting filament adjacent to auxiliary cell (Fig. 5).

Verlaque (1990) reported thirteen species of *Predaea* from tropical, subtropical and warm-temperate regions. Only five of these species are known from the Atlantic Ocean: *P. feldmannii* Børgesen, *P. weldii* Kajimura, *P. masonii* Setchell et Gardner (Verlaque, 1990), *P. pusilla* (Berthold) J. Feldmann (Ballesteros *et al.*, 1992) and *P. huismanii* Kraft (Sansón *et al.*, 1991), but *P. ollivieri* has previously been only reported from different localities of the Mediterranean Sea.

Chondria mairei G. Feldmann (Rhodomelaceae, Rhodophyta) (Figs 6-8)

Plants grew as epiphytes on leaves of *Cymodocea nodosa* (Ucria) Ascherson, the same substratum reported by Feldmann (1949) for the original specimens of this species collected in Argelia.

The genus *Chondria* is distinguished mainly by the organization of the filaments in the apical region of the axes, the branching and the position and morphology of reproductive structures (Gordon-Mills & Womersley, 1987). Garbary & Vandermeulen (1990) summarized 50 species of this genus, being *Chondria mairei*, *C. minutula* Weber-van Bosse and *C. pygmaea* Garbary et Vandermeulen those with the smallest habit and a basal system of prostrate axes. Plants studied are terete, up to 15 mm high, with 1-3 erect axes, unbranched or with few lateral branches (Fig. 6), arising from a small disc. Both tetrasporophytes and gametophytes were observed throughout the year. Tetrasporophytes form tetrahedrally divided tetrasporangia from the upper side of pericentral cells. Gametophytes develop cystocarps with a small basal spur and rounded spermatangial plates (Fig. 7), with 1-2 rows of large sterile cells at their periphery (Fig. 8).

As suggested by Garbary & Vandermeulen (1990), the diminutive size and stoloniferous growth of axes of this species perhaps are due to the extreme grazing pressure. Nevertheless, we also think that possibly these characters are caused by the

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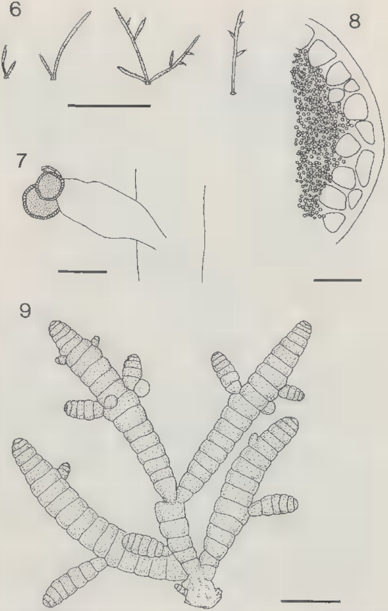
Figs 4-5. *Predaea ollivieri* J. Feldmann. - Fig. 4. Habit. (Scale bar = 2 cm). Fig. 5. Detail of cortical filaments showing a mature carposporophyte. Note small chains of nutritive cell (nc) arising from the proximal and two distal cells adjacent to the auxiliary cell (aux) and the origin of the carposporophyte from a lateral budge of the connecting filament (cf.) (Scale bar = 40 µm)



Figs 6-9. - Fig. 6-8. *Chondria mairei* G. Feldmann. Fig. 6. Variation of habit of plants. (Scale bar = 1 cm). Fig. 7. Arrangement of the rounded spermatangial plates. (Scale bar = 300 µm). Fig. 8. Detail of a spermatangial plate with 1-2 rows of sterile cells at the periphery. (Scale bar = 50 µm). Fig. 9. *Champia vieillardii* Kützing. Habit. (Scale bar = 2 mm).

nature of the substratum where this species develops, mainly the short life of leaves of different seagrasses. In this sense, Reyes (1993) observed that in months when *Cymodocea nodosa* leaves continued longer attached to rhizomes, plants of *Chondria mairei* reached up to 4 cm high and presented branching close to that of *Chondria tenuissima* (Goodenough et Woodward) C. Agardh. Subsequent studies are needed to verify if *Chondria mairei* could be an adapted form of *Chondria tenuissima* to this kind of substratum.

Chondria mairei has been reported from different localities in the Maditerranean Sea (Feldmann, 1949; Boudouresque, 1968; Coppejans, 1983) and the Red Sea (Lipkin, 1977). The new records from the Canary Islands extend its western limit of distribution and constitute the first reports from the Atlantic Ocean.

Champia vieillardii Kützing (Champiaceae, Rhodophyta) (Fig. 9)

Plants grew on rhizomes of *Cymodocea nodosa* in the sublittoral to 6 m depth at El Médano. Specimens studied are up to 2 cm high (Fig. 9), frequently with semiprostrate habit due to the descending growth of some lateral branches attached by a discoid holdfast. Axes are markedly compressed, with alternate to opposite branching.

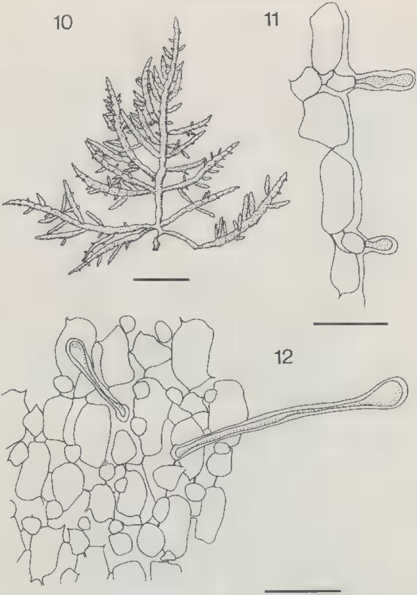
Champia vieillardii is considered a pantropical species (Lawson & John, 1982). It has been reported from Vietnam (Dawson, 1954), Kenya (Isaac, 1967) and Ghana (Lawson & John, 1982) and, according to Wynne (1986), from Venezuela and Puerto Rico, as *Champia compressa* Harvey. The difference between both species has been discussed by Dawson (1954) and more recently by Reedman & Womersley (1976). Dawson (1954) considered that the main features for *Champia vieillardii* are its markedly flattened branches, the proximity between successive lateral branches, and the shortness and cylindrical section of its last order branches, characters observed in our plants.

Champia salicornoides Harvey (Champiaceae, Rhodophyta) (Fig. 10-12)

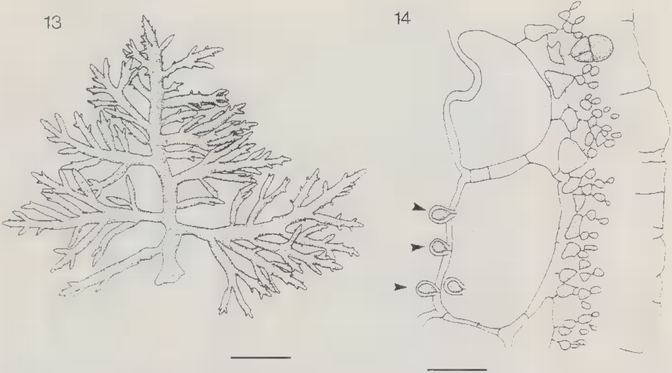
Plants grew epilithically, in upper sublittoral at Cotillo, occasionally in low eulittoral pools. Specimens studied are up to 5 cm high (Fig. 10), subgelatinous, attached by a discoid holdfast. Axes and lateral branches are terete and present irregularly opposite, alternate or whorled branches, arising always from monostromatic transversal septa formed between successive hollow segment (Fig. 10), as reported by Børgesen (1920).

Bigelow (1887) and De Toni (1900) considered this species only as a variety of *Champia parvula* (C. Agardh) Harvey. However, Børgesen (1920) pointed out that these species were different due to (1) the bigger size of *Champia salicornoides;* (2) the arrangement of tetrasporangia, forming broad belts in *C. parvula*, scattered in *C. salicornoides*; (3) the presence of several more medullary filaments in *C. salicornoides;* and (4) the greater number of cells of these filaments between two successive septa in this last species.

Although Børgesen (1920) reported in *Champia salicornoides* the occurrence of small flattened cortical cells bearing gland cells arranged vertically outwards, we think



Figs 10-12. *Champia salicornoides* Harvey. - Fig. 10. Habit. (Scale bar = 1 cm). Fig. 11. Longitudinal section of the thallus showing early stages of development of hairs from small cortical cells. (Scale bar = 50 µm). Fig. 12. Superficial view of the thallus showing developed hairs. (Scale bar = 50 µm).



Figs 13-14: *Chrysymenia ventricosa* (Lamouroux) J. Agardh. - Fig. 13. Habit. (Scale bar = 2 cm). Fig. 14. Transverse section of thallus showing large inner cortical cells with gland cells (arrows) and a tetrasporangium formed from outer cortical cell. (Scale bar= 50 μm).

that they were early stages of development of hairs, as may be observed in Figs 11-12 from our plants.

Champia salicornoides is a widespread species, distributed along warm temperate and tropical seas, both in western Atlantic (Børgesen, 1920; Taylor, 1960) and in eastern Atlantic coasts (Lawson & John, 1982). The new records from the Canary Islands are then not unexpected.

Chrysymenia ventricosa (Lamouroux) J. Agardh (Rhodymeniaceae, Rhodophyta) (Figs 13-14)

We have found few specimens of this species in the sublittoral at Cotillo, growing together with *Halymenia floresia* (Clemente) C. Agardh and *Halymenia elongata* C. Agardh, showing a markedly iridescence, with successive greenish and yellowish broad bands. Specimens studied are briefly stipitate, up to 15 cm high, with unconstricted axes and branches (Fig. 13), somewhat flattened at the basal region and subcylindrical towards the apices. Axes are alternately, radially or irregularly branched, consisting of a central cavity surrounded by large inner cortical cells that become smaller outwards (Fig. 14). Only in older parts of plants, loose medullary branched filaments are formed from the inner cortical cells. Now and then, groups of pyriform gland cells were observed arising directly from inner cortical cells (Fig. 14) or from small special cells formed inwards. All plants collected were tetrasporophytes, bearing cruciately divided tetrasporangia formed from outer cortical cells (Fig. 14).

Chrysymenia ventricosa is a widespread species reported from tropical and subtropical coasts of western Atlantic (Wynne, 1986), eastern Atlantic Ocean (South & Tittley, 1986) and the Mediterranean Sea (Ballesteros, 1990). The presence of this species in the Canary Islands extends its southern limit of distribution.

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